

CLAIMS

What is claimed is:

1. A method of indicating the presence of mechanical impact on a material, comprising the steps of  
providing the material having a surface;  
preparing an indicator paint having an impact-sensitive component that produces a visible change when subjected to a mechanical impact;  
applying the indicator paint to the surface of the material;  
placing the material having the indicator paint thereon into circumstances where it may be subject to the mechanical impact; and thereafter  
inspecting the material having the indicator paint thereon for the presence of the visible change.
2. The method of claim 1, wherein the step of providing includes the step of  
providing the material as a low-ductility material having a tensile elongation to failure of less than about 2 percent.
3. The method of claim 1, wherein the step of providing the material includes the step of  
providing a composite material having a tensile elongation to failure of less than about 2 percent.
4. The method of claim 1, wherein the step of providing the material includes the step of  
providing a polymer-matrix composite material having a tensile elongation to failure of less than about 2 percent.

5. The method of claim 1, wherein the step of providing the material includes the step of  
providing a ceramic material having a tensile elongation to failure of less than about 2 percent.

6. The method of claim 1, wherein the step of preparing the indicator paint includes the step of  
preparing the indicator paint having the impact-sensitive component that changes color when subjected to the mechanical impact;

7. The method of claim 1, wherein the step of preparing the indicator paint includes the step of  
preparing the indicator paint comprising  
a first reactant, and  
a second reactant,  
wherein the first reactant and the second reactant are separated by a barrier that is ruptured when the indicator paint is subjected to the impact.

8. The method of claim 1, wherein the step of preparing the indicator paint includes the step of  
preparing the indicator paint comprising  
an encapsulated first reactant, and  
a second reactant,  
wherein the first reactant and the second reactant react together to produce the visible change upon the impact.

9. The method of claim 1, wherein the step of preparing the indicator paint includes the step of  
preparing the indicator paint that does not emit light when subjected to the mechanical impact.

10. The method of claim 1, wherein the step of placing includes the step of not instrumenting the material having the paint thereon with light-detection instrumentation.

11. The method of claim 1, wherein the step of inspecting includes the step of inspecting the material having the indicator paint thereon by an unaided eye.

12. The method of claim 1, including an additional step, after the step of inspecting, of determining a design limit for the composite material responsive to an observability of impact indications.

13. The method of claim 1, including an additional step, after the step of inspecting, of determining a first design limit for the composite material in the event that it has the indicator paint applied thereto, and a second design limit for the composite material in the event that it has no indicator paint applied thereto..

14. A method of indicating the presence of mechanical impact on a composite material, comprising the steps of providing the composite material having a surface, wherein the composite material has a tensile elongation to failure of less than about 2 percent; preparing an indicator paint having an impact-sensitive component that changes color when subjected to a mechanical impact, wherein the indicator paint comprises a first reactant, and a second reactant, wherein the first reactant and the second reactant are separated by a barrier that is ruptured when the indicator paint is subjected to the mechanical impact; applying the indicator paint to the surface of the composite material;

placing the composite material having the indicator paint thereon into circumstances where it may be subject to the mechanical impact; and thereafter

inspecting the composite material having the indicator paint thereon for the presence of a color change.

15. The method of claim 14, wherein the step of preparing the indicator paint includes the step of

preparing the indicator paint that does not emit light when subjected to the mechanical impact.

16. The method of claim 14, wherein the step of placing includes the step of not instrumenting the composite material having the paint thereon with light-detection instrumentation.

17. The method of claim 14, wherein the step of inspecting includes the step of

inspecting the composite material having the indicator paint thereon by an unaided eye.

18. The method of claim 14, including an additional step, after the step of inspecting, of

determining a design limit for the composite material responsive to an observability of impact indications.

19. The method of claim 14, including an additional step, after the step of inspecting, of

determining a first design limit for the composite material in the event that it has the indicator paint applied thereto, and a second design limit for the composite material in the event that it has no indicator paint applied thereto..

20. An article comprising:  
a substrate having a surface; and  
a paint applied to the surface of the article, wherein the paint comprises  
a plurality of microcapsules, and wherein each microcapsules comprises  
a first reactant, and  
a matrix comprising a paint binder and a second reactant,  
where the first reactant and the second reactant produce a color in the paint when  
mixed.

21. A method for establishing a design standard for a low-ductility material,  
comprising the steps of:

setting a first design standard for the low-ductility material having an indicator  
paint applied thereto, wherein the indicator paint has an impact-sensitive component  
that produces a visible change when subjected to a mechanical impact; and

setting a second design standard for the low-ductility material which does not  
have the indicator paint applied thereto.

22. The method of claim 21, wherein the step of setting the first design  
standard includes the step of

setting the first design standard with a unity damage-tolerance factor, and  
wherein the step of setting the second design standard includes the step of

setting the second design standard with a damage-tolerance factor greater than  
unity.

23. The method of claim 21, wherein the step of setting the first design  
standard includes the step of

setting the first design standard with a first damage-tolerance factor, and wherein  
the step of setting the second design standard includes the step of

setting the second design standard with a second damage-tolerance factor that  
is greater than the first damage tolerance factor.